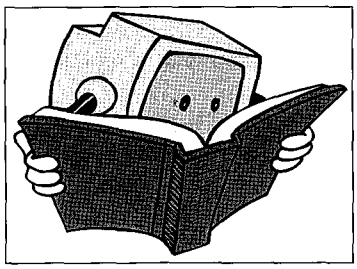
HITACHI

No. SM00008



SERVICE MANUAL

C2117T
CP2117R/T
CS2117R/T*

HITA-02931

CAUTION:

Before servicing this chassis, it is important that the service technician read the "Safety Precautions" and "Product Safety Notices" in this service manual.

Data contained within this Service manual is subject to alteration for improvement.

*** This Model has NO Production Plan - Circuits & Parts List are not included in this Service Manual**

TECHNICAL SPECIFICATIONS

TV Standard . . . . .625 lines,
C Models . ... .STANDARD I
CP Models..... .... .. STANDARD BG
CS Models . .. STANDARD BG/DK
All above 525 lines NTSC 4 43 MHz

Channel coverage . .. . . UHF Channels (UK)
UHF/VHF Hyper band (Export)

Aerial input impedance 75 ohm unbalanced

Programme Selectors 10 key buttons on the remote control, with UP/DOWN buttons on the front of TV

Power Consumption
2117 ... . 55 W

Picture tubes
2117 . . . . 51 cm type

Mains Voltage .. . . .. 220V~240V 50 Hz

Fuse . .. . T3.15AL Type

Focusing .. .. Electro static

SAFETY PRECAUTIONS

WARNING: The following precautions should be observed .

1. Do not install, remove, or handle the picture tube in any manner unless shatter proof goggles are worn. People not so equipped should be kept away while picture tubes are handled. Keep the picture tube away from the body while handling.

2. When service is required, an isolation transformer should be inserted between the power line and the receiver before any service is performed on the chassis.

3. When replacing the chassis in the cabinet, ensure all the protective devices are put back in place.

4. When service is required, observe the original lead dressing. Extra precaution should be taken to ensure correct lead dressing in the high voltage circuitry area.

5. Always use the manufacturer's replacement component. Always replace original spacers and maintain lead lengths. Especially critical components are indicated thus ⚠ on the parts list and should not be replaced by other makes. Furthermore, where a short circuit has occurred, replace those components that indicate evidence of overheating.

6. Before returning a serviced receiver to the customer, the service technician must thoroughly test the unit to be certain that it is completely safe to operate without danger of electrical shock, and be sure that no protective device built into the instrument by the manufacturer has become defective, or inadvertently damaged during servicing.

Therefore, the following checks are recommended for the continued protection of the customers and service technicians.

INSULATION

Insulation resistance should not be less than 10M ohms at 500V DC between the main poles and any accessible metal parts.

Also, no flashover or breakdown should occur during the dielectric strength test, applying 3kV AC or 4.25kV DC for two seconds between the main poles and accessible metal parts.

HIGH VOLTAGE

High voltage should always be kept at the rated value of the chassis and no higher. Operating at higher voltages may cause a failure of the picture tube or high voltage supply, and also, under certain circumstances could produce X-radiation levels moderately in excess of design levels. The high voltage must not, under any circumstances, exceed 29kV on the chassis.

X-RADIATION

TUBES: The primary source of X-radiation in this receiver is the picture tube. The tube utilised for the above mentioned function in this chassis is specially constructed to limit X-radiation.

For continued X-radiation protection, replace tube with the same type as the original HITACHI approved type.

PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in HITACHI television receivers have special safety related characteristics. These characteristics are often not evident from visual inspection, nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified by marking with a ⚠ on the schematics and the replacement parts list contained in this service manual.

The use of a substitute replacement component which does not have the same safety characteristics as the HITACHI recommended replacement one, shown in the parts list of this service manual, may create electrical shock, fire, X-radiation, or other hazards.

Product Safety is continuously under review, and new instructions are issued from time to time. For the latest information, always consult the current HITACHI service manual. A subscription to, or additional copies of HITACHI service manuals may be obtained at a nominal charge from your HITACHI SALES CORPORATION.

CE MARK

Some of these models may contain the CE mark on the rating plate.

This illustrates that the T.V. contains parts that have been specifically approved to provide electromagnetic compatability to designated levels.

Therefore, when replacing any part in this T.V., please use only the correct part itemized in the parts list of this service manual to ensure this standard is maintained.

Also, take care to replace lead dressing to its original state, as this can also have a bearing on the electromagnetic radiation/immunity.

TUBE DISCHARGE

The line output stage can develop voltages in excess of 25kV; if the E.H.T. cap is required to be removed, discharge the anode to chassis via a high value resistor, prior to its removal from the tube.

CIRCUIT DESCRIPTION

Tuner and I.F. Stages:

The tuner used on this chassis, is powered by the +5V supply. The CP, CL and CS models cover the VHF-L, VHFH and UHF bands whilst the 'C' models cover UHF only.

During tuning, the mark/space ratio output from pin 1 of IC001 changes. This is applied to the base of Q001 via R039, and the resultant voltage at the collector is filtered and applied to the VT terminal of the tuner.

Signal recognition is performed by IC201 in conjunction with IC001, and is explained later in the Remote Control and Tuning Circuit description.

Band switching: CP and CS models

IC001 performs the necessary band switching in conjunction with Q100.

"High" or "Low" outputs are obtained from pins 11 and 12 of IC001, then applied to pins 3 and 4 of the tuner terminals. These select the UHF or VHF-H bands.

When VHF-L band is selected, pins 11 and 12 of IC001 will both go "Low". Q100 will then turn off, and approximately +5v is applied to the VHF-L terminal of the tuner via R106.

Therefore, which of the tuner terminals BU, BH, or BL has a +5v applied to it depends on these "High" or "Low" outputs.

UHF only: 'C' Models

A +5V is applied via R105 to the UHF (pin 3) terminal of the tuner only.

The I.F. output from the tuner is applied to pins 45 and 46 of IC201 via the SAW filter CP201.

Sound I.F. stages: C and CP models

The sound stages consist of IC201, which basically performs the required demodulation, and IC401, which is the output amplifier.

The I.F. signal from the tuner is fed via saw filter CP201, and applied to IC201 at pins 45 and 46.

The composite signal available from pin 7 of IC201 is applied to the filter network of MF422, via L401A etc., then fed to pin 5 of IC201 via Q421 and C422.

Demodulation is then performed within the IC, with the sound output being obtained from pin 50.

Sound I.F. stage: CS models

The sound stages consist of IC4001, which performs the change from I.F. to intercarrier, IC201 which demodulates the signal and IC401 which is the output amplifier.

The I.F. signal from the tuner is fed via the sawfilter MF4003, and applied to IC4001 at pin 1.

The resultant intercarrier is available at pin 12 of IC4001 and fed via the filter network consisting of MF422 (5.5MHz intercarrier) and MF421 (6.5MHz intercarrier) and Q421 to Pin 5 via C422.

Demodulation is then performed within the IC, with the sound output being obtained from pin 50.

Audio

From pin 50 of IC201 it is then applied to pin 3 of IC401 via Q401, C421 and R413, amplified, then output to the speaker from pins 6 and 8.

Should C417 on pin 2 of IC401 or its output go short circuit the base of Q440 will become "Low", and it will turn on. A voltage will then be applied to the base of Q705, which then turns off Q952, and as a result the +12v supply is removed, thus preventing damage occurring to IC401. How the +12v is removed will be described in more detail later during the horizontal circuit description.

Volume control is performed by the DC voltage applied to pin 5 of IC201.

This is determined by the Pulse Width Modulated output from pin 2 of IC001, which is then fed to IC201 after filtering via R017/R028 etc.

Under no signal conditions, or when the "SEARCH" routine is initiated, pin 4 of IC201 (ident) will go "Low". When this happens, internal circuits in IC201 prevent any sound output from being obtained.

Demodulated sound is also available at pin 1 of IC201. It is then connected to pins 1 and 3 of the 21 pin Euro socket, via Q453 network for gain and impedance/level matching.

If desired, this output can then be applied to external equipment via an appropriate connecting plug.

Audio signals from **external** equipment can be applied to the 21 pin Euro socket at pins 2 and 6 and these will be fed via R403/R404 and C452 to Pin 6 of IC201.

Audio signals can also be applied to the front phono sockets and these will be applied to pin 6 of IC201 via L151, R406 and C452.

A separate switching voltage is also applied to pin 16 of IC201 when external equipment is connected. The external sound signal applied to pin 6 will then be switched to the output of IC201 (pin 50).

This is then further amplified by IC401, as previously described.

Volume control of the external audio signal is obtained in the same way as for internal sound, i.e., by the voltage level at pin 5 of IC201.

(How the switching voltages are obtained for IC201, will be explained in the Tuning and Control Circuit description).

Vision I.F. Stages:

The I.F. signal from CP201 is applied to pins 45 and 46 of IC201. These pins supply an internal amplifier consisting of three stages whose gain is controlled by the A.G.C. circuit. The speed of response from this internal A.G.C. stage is determined by C205, connected to pin 48.

The output from the internal amplifier is then input to a quasi synchronous demodulator stage, where the signal is multiplied by its own carrier, i.e. the reference signal.

This reference signal is obtained from the input signal using the tank circuitry of L202 etc. connected between pins 2 and 3 of the I.C.

The reference signal is limited by a clamping circuit, and is then applied to the demodulator.

A control voltage from pin 47 of IC201 determines the RF A.G.C. of the tuner.

The tuner take over point is determined by the voltage applied to pin 49, which is governed by the setting of VR202.

The composite video finally emerges at pin 7 of IC201.

Luminance Circuitry

The composite video signal from pin 7 of IC201 via buffer transistor Q501, is applied to the sound rejection filter MF501, (6.0MHz, 'C' model) (5.5MHz CP and CS models) and on the CS models there is an additional filter in parallel with MF501 marked MF502 which is for frequency 6.5MHz as this model has dual sound.

The resulting **internal** luminance signal is then applied to:-

a: Pin 19 of the Euro socket, from where it can be output to external equipment if desired.

b: Pin 13 of IC201 via Q301 buffer, for colour decoding and deflection synchronisation.

c: Pin 23 of IC001 via R068/R069 divider network for TEXT.

The luminance signal is added internally to the RGB matrix circuits of IC201, and will be controlled by the brightness, contrast, and blanking stages of the I.C.

The luminance signal finally emerges with the RGB signals from pins 18, 19 and 20 of IC201.

The voltages which control the contrast and brightness levels are output from pins 5 and 6 of IC001, then applied to pins 25 and 17 of IC201.

An automatic beam current limit circuit is employed on this chassis. Should the beam current start to rise, the voltage at pin 4 of the flyback transformer will fall. This fall is fed to Q752, tuning the transistor on and pulling its emitter voltage low.

This fall in voltage is applied to pin 25 of IC201 via D709/R723 and R527, effectively reducing the contrast level, and hence the beam current.

Video signals from **external** equipment can be connected to pin 20 of the 21 pin Euro socket where they will be applied via Q460 and Q461 to:-

a: Pin 15 of IC201 via C311.

b: Pin 24 of IC001 for TEXT.

External video signals from the front phono socket can also be applied via Q460 and Q461 to the above.

The switching voltage at pin 16 of IC201, ensures that only the external signals are processed by IC201.

How the switching voltages are obtained will be explained in the Remote Control and Tuning Circuit description:

Chrominance Circuitry:

IC201 is designed to demodulate PAL and NTSC. On CS models an additional SECAM colour system is used.

On models operating in the PAL mode the demodulated R-y and B-y colour signals are made available from pins 30 and 31 of IC201, then fed to pins 14 and 16 of IC501, which is a switch capacitor delay line.

The signals at pins 14 and 16 are clamped, then fed via an internal buffer stage to delay lines, which are driven by a clock signal of 3MHz to obtain a delay period of 64uS. This internal clock is generated from a 6MHz voltage controlled oscillator, and line locked by the sandcastle pulse input at pin 5. Low pass filters after the delay line stages suppress the unwanted clock signals.

The undelayed and the delayed signals are then added, with the resulting R-y and B-y signals being output from pins 11 and 12. These are then fed to IC201 at pins 28 and 29.

IC201 contains clamping circuits, and a DC colour saturation control, the level of which is set by the voltage applied to pin 26 from pin 4 of IC001. The signals are then applied to a MATRIX circuit, and finally emerge from pins 18, 19 and 20 as the blue, green, and red signals.

On models (CS) capable of receiving SECAM transmissions, the R-y and B-y signals from pins 30 and 31 are also connected to pins 9 and 10 of IC502. This IC will then produce control voltages from pins 1 and 16. These are applied to pins 32 and 27 of IC201, and condition the I.C. to process the SECAM signals, thereby producing blue, green, and red outputs from pins 18, 19 and 20. The sandcastle pulse is also connected to pin 15 of IC502 to control its operation.

If NTSC signals are received on a CS model pin 34 (R model), pin 30 (T model) of IC001 goes "low". This turns Q014 off, which then causes Q013 to turn off, and the voltage level at pin 27 of IC201 will fall to a voltage between 0-5V originating from the hue control, pin 3 of IC001 via R063, R078, R116 and L052.

If now the signal received is SECAM or PAL the reverse will occur finally leaving pin 27 of IC201 high with a voltage of approximately 6V.

For C and CP models pin 27 is held at 3V by the divider network R528/R529 for PAL and NTSC reception with fixed hue setting for NTSC.

Remote Control and Tuning Circuitry:

The remote control receiving unit U001, contains an infra red amplifier. This is powered by the standby +5v supply, which is obtained from the +12v supply via Q957, and stabilised by ZD006.

The output from pin 3 of the infra red amplifier is applied to pin 35 of IC001 ('R' models, non text), pin 45 of IC001 ('T' models).

This I.C., performs channel selection, UP/DOWN analogue control, on-screen display, search tuning, and also controls inputs and outputs to and from the external input sockets.

IC002 is the memory I.C., which stores all data relating to the above functions, then transfers that information to IC001 when required.

IC001 and IC002 are both powered by the standby +5v supply.

X001, C026 and C027, connected between pins 31 and 32 ('R' models) or pin 41 and 42 ('T' models) supply IC001 with a basic clock frequency to control all operating mode requirements.

IC001 must be initially reset from switch on, and this is achieved by Q004.

As the +5v supply begins to rise from switch on, pin 33 ('R' models) or pin 43 ('T' models) of IC001 is held "High" via R075, thus resetting the I.C.

The "High" is removed from this pin when C002 becomes charged via R015 and D003, causing Q004 to switch on, thus releasing the reset condition.

When the search routine has been initiated and a signal has been located, pin 4 of IC201 will become "High". This is applied to pin 41 ('R' models) or pin 5 ('T' models) of 'IC001' and informs the I.C. that a signal is present.

The search routine then stops, and the I.C. will monitor the AFC signal present at pin 9 to obtain the optimum signal.

Contrast, colour, brightness, hue, sharpness and volume, are all controlled from the remote control handset (can also be adjusted by the + and - buttons on the front of the T.V.), and will produce DC level changes from pins 2 - 7 of IC001. These changes are then applied to the relevant pins of IC201.

Pins 36 to 38 ('R' models) or pins 46 to 48 ('T' models) form the in and out matrix for the front control operations.

Pins 39 to 40 ('R' models) or pin 49 and 50 ('T' models) provide clock and data information. These are connected to the memory IC002.

When external equipment connected to the 21 pin Euro socket is turned on, +12v is output from pin 8 of the socket to D006. The diode then becomes forward biased, and applies approximately +5v to pin 10 of IC001 via potential divider R035, R036.

From pin 15 of IC001 an output, "high" is then applied to the base of Q007 turning it hard on and pulling its collector "low". As a result Q005 will turn off, thereby supplying approximately 8V to pin 16 of IC201 via the potential divider network of R024/R103.

This ensures IC201 will process only the external inputs applied to pins 6 and 15.

If the external equipment does not have an equivalent 21 pin Euro connector, or if the external inputs are applied via the phono sockets on the front of the T.V., then the AV

button on the remote control has to be pressed to select the external mode. This will then produce the required "High" from pin 15 (IC001) to achieve the necessary switching voltages.

When a command requiring an on-screen display is received by IC001, a"High" is made available at pin 25 ('R' model) pin 35 ('T' model).

This is applied via D039A to pin 21 of IC201, and blanks out a portion of the picture. The on-screen display information is then inserted into this portion, thus resulting in a clear display.

'R' models

The components L024, C024, and C013, on pins 28 and 29, determine the display oscillator frequency, whilst the horizontal and vertical inputs at pins 26 and 27 determine the actual position of the on-screen display.

'T' models

The character display is generated from the text character set, whilst the horizontal and vertical inputs at pins 36 and 37 determine the actual position of the on screen display.

Timer and Standby

When the "OFF" timer mode has been set, and the time input has elapsed, pin 20 of IC001 outputs a "Low". This removes the drive supplied to the base of Q952, and as a result the +9v supply from IC951 disappears. This places the T.V. into its standby mode of operation by shutting down the E.H.T. generation stages of IC201.

Also, pin 19 of IC001 is taken 'low' causing the illumination level of D001 to increase.

This sequence also applies when putting the TV into standby mode via the handset.

Deflection Circuits:

The deflection circuitry of IC201 contains a sync. separator stage, horizontal oscillator and output stages, a vertical countdown and output stage.

Horizontal Stage:

An internal composite video signal from pin 7 of IC201 is returned to pin 13 or an external signal from the 21 pin Euro socket is applied to pin 15 of IC201 as previously explained.

One of these inputs, pin 13 or 15 via the internal/external switch of IC201 is applied to the internal sync. separator stages of the IC.

An internal phase detector stage is provided with a sawtooth waveform, generated from the line pulse input to pin 38. The phase detector then compares this sawtooth waveform to the sync. pulse.

Should any frequency drift occur, a corrective output will be applied to the horizontal oscillator, thereby maintaining the desired phase relationship.

The components connected to pin 40 form a filter network for the phase detector, and VR701 connected to pin 39 provides manual phase control.

The horizontal output emerges at pin 37 and is then applied to the base of line drive transistor Q701.

T701 couples Q701 to the line output transistor Q702. Both these transistors are powered by the +B (H.T.) supply.

A line pulse available at pin 1 of the flyback transformer is rectified by D701, smoothed by C716, and provides approximately 200v to drive the video output transistors Q801, Q802, and Q803 on the C.R.T. base.

Under certain fault conditions, i.e. increased H.T. supply, or low line oscillator frequency etc., an excess of E.H.T. could be developed.

To prevent this happening, the rectified voltage of D701 is fed via potential divider R715, R716, and applied to pin 3 of the comparator IC701. Should the E.H.T. rise excessively, the voltage level at pin 3 of IC701 will exceed the threshold level determined by ZD704 (5v1 Zener) at pin 2.

When this happens, the output at pin 1 of IC701 becomes "High", causing Q705 to conduct and pulling pin 20 of IC001 low. After a short period of time, the low at pin 20 of IC001 causes the I.C. to latch into its standby mode, and a "Low" will be applied to the base of Q952, turning the transistor off.

Consequently, Q953 is turned off, and the +9v supply to IC201 will be removed, thereby shutting down the deflection stages of the I.C. and preventing further E.H.T. generation.

Excessive beam current can also occur under certain fault conditions, so this is prevented in the following manner.

The H.T. current to the horizontal output stages is measured by R727.

Should the current rise, the increased voltage drop across R727 will cause Q704 to be turned on, and a voltage will be applied to the base of Q705 via R729.

This will then prevent further E.H.T. generation as previously described.

Vertical Stages:

The internal vertical sync. of IC201 is fed to a triggered vertical divider stage, which counts down the horizontal frequency to obtain the vertical frequency. This eliminates the need for a conventional oscillator circuit, and has the added advantage that no external frequency control is required.

C601/C601A at pin 42 of the I.C. are used for ramp generation, producing the required sawtooth.

The vertical output from pin 43 of IC201 is applied to pin 4 of IC601 via R604. The components D601 and C605 determine the flyback generation time, and the vertical output to drive the deflection coils is made available from pin 2.

A supply of +25v is required for IC601. This is obtained from pin 6 of the flyback transformer, rectified by D702/D702A, smoothed by C719, then applied to pin 6 of IC601.

The deflection current that occurs at the junction of C609/R609 is added to the feedback from R607/C608 etc, and the result is applied to pin 41 of IC201. The values of R607 and C608 determine the linearity, whilst VR601 sets the vertical height.

When the 16:9 ratio format is selected, a "High" is made available from pin 16 of IC001. This is applied to Q015 via R121, turning the transistor off.

This effectively removes R125 from pin 42 of IC201, thus reducing the current and changing the vertical ramp output. In this way, the vertical height is corrected to suit the 16:9 wide screen format.

Power Supply Circuit:

The AC input is rectified by D901 - 04, and produces approximately 300v at the collector of Q903.

Current flowing through R901, causes Q903 to initially turn on.

Secondary voltages are then induced in T901, and a feedback voltage is obtained via D905, L903 etc., and applied to Q903 base, maintaining the transistors operation.

This circuitry self oscillates at a frequency determined by the inductance of the transformer, the AC mains voltage, and load conditions etc.

The secondary voltage induced in the S1 - S2 winding is rectified by D951 to produce the +B (H.T.), which is smoothed by C952.

The S3-S4 winding produces +12v via D952, and this is smoothed by C954.

It is then applied to Q953, and in conjunction with IC951 produces the chassis +9v supply.

Q951 stage controls the H.T. regulation.

The base of Q951 is set to a pre-determined level by the resistor network R952, VR951, and R951.

Should the H.T. rise, the base current fed to Q951 will increase, turning the transistor on harder. This causes more current to flow through the opto-coupler IC901.

An output is then produced from pin 5 of the opto-coupler, which is applied to the transistor network Q901, Q902.

As these transistors control the on time of the power transistor Q903, a constant and regulated H.T. level is maintained.

ZD952 offers protection to the H.T. circuits should the voltage level rise excessively.

When the standby mode is selected, pin 20 of IC001 will go "Low", removing the drive to Q952.

As a result, Q953 is turned off, and the +9v to IC201 disappears, therefore shutting down the deflection stages of the IC201. E.H.T. generation will then cease for as long as the standby condition exists.

PICTURE AND CONTROL ADJUSTMENTS

H.T. Adjustment (+B):

1. Switch T V. on, receive Philip's circle test pattern, and set contrast and brightness levels to maximum.
2. Connect a voltmeter between the +ve leg of C709 and Ground.
3 Adjust VR951 so that meter reads as follows:-
   51cm models 112v ± 0v2

A.F.C. Alignment: (L202 Adjustment)

1 Switch on the T V. and apply an I.F signal (38 9MHz) with a level between 10 and 0 dBm, to pin 1 of CP201
2 On CS models only, set the standard selection to AUTO in the Installation menu. (see operating guide for Installation menu examples).
3 Connect an oscilloscope and a voltmeter to pin 44 of IC201.
4. Adjust L202 until fast rate of change is seen on the oscilloscope, then carefully adjust L202 until voltmeter reads 4 0v + 0.2v

AGC Adjustment:

1. Switch T V on and allow to warm up for at least two minutes
2. Receive a signal with a level of -47dBm
3 Connect a voltmeter to the AGC terminal of the tuner unit.
4 Adjust VR202 until meter reads 2v5 +/- 0v2

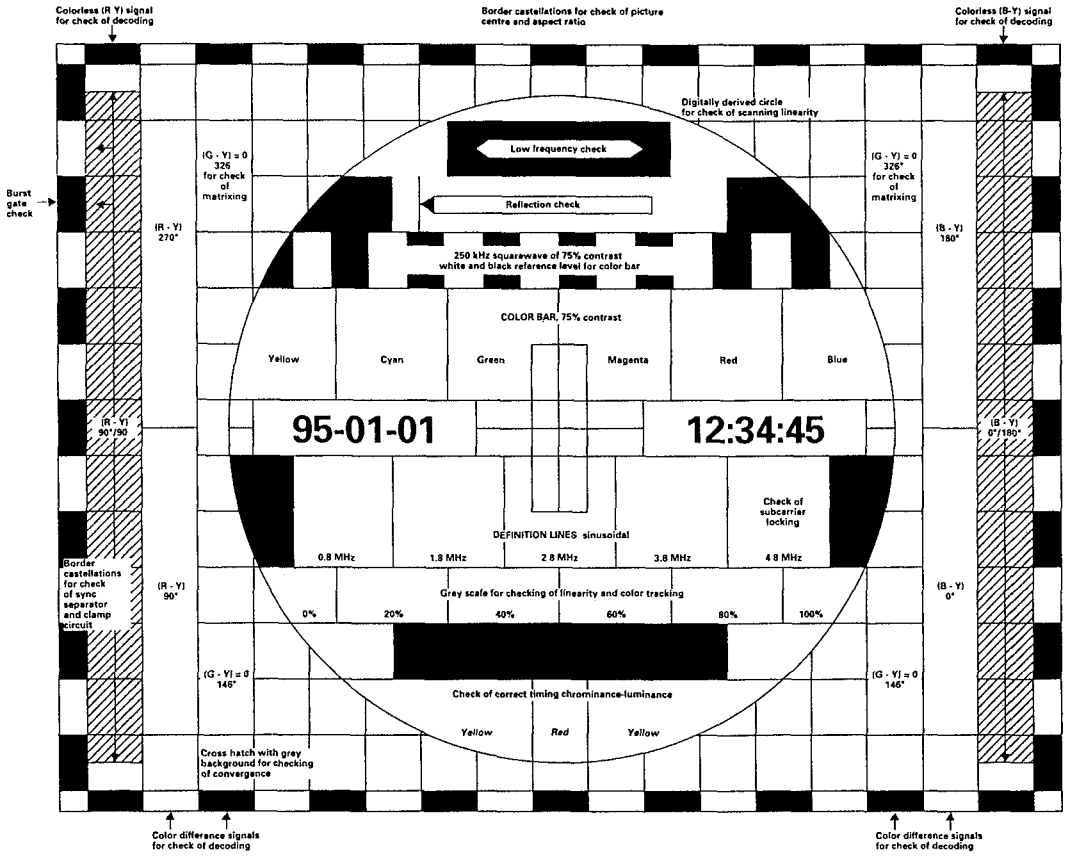
Horizontal Phase/Vertical Centre/Vertical Amplitude:

1 Receive Philip's circle test pattern.
2. Set brightness and contrast levels to maximum, then face the television to the North or South.
3 Adjust VR701 to centralise circle pattern.
4. Connect the removable plug on E601 to the pins which achieve the best vertical centre position.
5 Adjust VR601 to obtain the required vertical height
6. Return brightness and contrast levels to their previous levels

Focus Adjustment:

1. Receive Philip's circle test pattern setting colour level to minimum, and contrast and brightness levels to maximum
2 Adjust contrast so that the first two bars of the colour bar display become black
3. Adjust brightness so that the 3rd and 4th bars of the grey scale bar display are the same colour black as in step 2
4 Adjust the focus control (upper control on flyback transformer) to obtain the best overall focus.

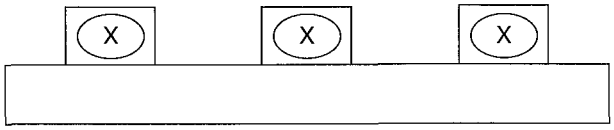
COMPOSITION OF TEST CARD PROVIDED BY PHILIPS PM5644 COLOR PATTERN GENERATOR


Colorless (R-Y) signal for check of decoding
Border castellations for check of picture centre and aspect ratio
Colorless (B-Y) signal for check of decoding
Digitally derived circle for check of scanning linearity
Low frequency check
Reflection check
250 kHz squarewave of 75% contrast white and black reference level for color bar
COLOR BAR, 75% contrast
Yellow
Cyan
Green
Magenta
Red
Blue
95-01-01
12:34:45
DEFINITION LINES sinusoidal
0.8 MHz
1.8 MHz
2.8 MHz
3.8 MHz
4.8 MHz
Check of subcarrier locking
Grey scale for checking of linearity and color tracking
0%
20%
40%
60%
80%
100%
Check of correct timing chrominance-luminance
Yellow
Red
Yellow
Cross hatch with grey background for checking of convergence
Burst gate check
(G - Y) = 0 326 for check of matrixing
(R - Y) 270°
(R - Y) 90°/90
(R - Y) 90°
(G - Y) = 0 146°
(G - Y) = 0 326° for check of matrixing
(B - Y) 180°
(B - Y) 0°/180°
(B - Y) 0°
(G - Y) = 0 146°
Border castellations for check of sync separator and clamp circuit
Color difference signals for check of decoding
Color difference signals for check of decoding

CUT OFF AND SCREEN ADJUSTMENT

PREPARATION

(i) Preset the red, green and blue background controls on the C.R.T. base to the positions shown. (Approximately mid. point).



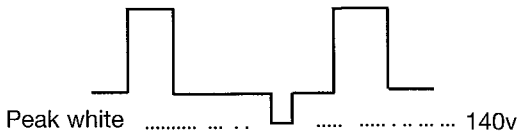
Component Side

(ii) Set the customer controls as follows:- Contrast = 0
Colour = 0
Brightness = middle of scale

(iii) Receive horizontal white line, or red raster pattern from a Philip's pattern generator.

METHOD:

1. Adjust screen control (lower control on the flyback transformer) until the horizontal line is just visible and its colour can be seen.
2. Do not touch the background control of the colour that is most prominent on the screen, but adjust the other two background controls until a reasonable white line is obtained
3. Connect an oscilloscope probe to each of the R.G.B. cathodes in turn and leave connected to the one with the highest level.
4. Set customer brightness so that the cathode value is no greater than 140v as shown below.



5. Disconnect oscilloscope, and set screen control so that the white horizontal line is just visible once more.

WHITE BALANCE

PREPARATION:

(i) Set the customer controls as follows:- Contrast = 0 Colour = 0

(ii) Receive the white raster pattern.

(iii) Obtain and set up a combined colour analyser and light meter, e.g. MINOLTA CA100.

METHOD:

1. Adjust brightness customer control so that the light output from the white raster reads Y = 1 ⟶ 2 cdm^{-2} on the light meter.
2. Next adjust the red and blue background controls to obtain the colour chromaticity co-ordinates of x = 283 y = 299 representing a colour temperature of 9300k (models C, CS and CP/481/381).

   For colour temperature of 7400k the red and blue background controls will have to be adjusted to obtain the colour chromaticity co-ordinates of x = 304 y = 320 (for all CP models other than shown above).

PROTECTION CHECKS

High Voltage Limit Check:

1. Switch T.V. on and set contrast and brightness levels to maximum.
2. For models 34cm and 41cm, connect a 1M4 resistor in parallel with R715 and ensure that the picture and sound disappear instantly.

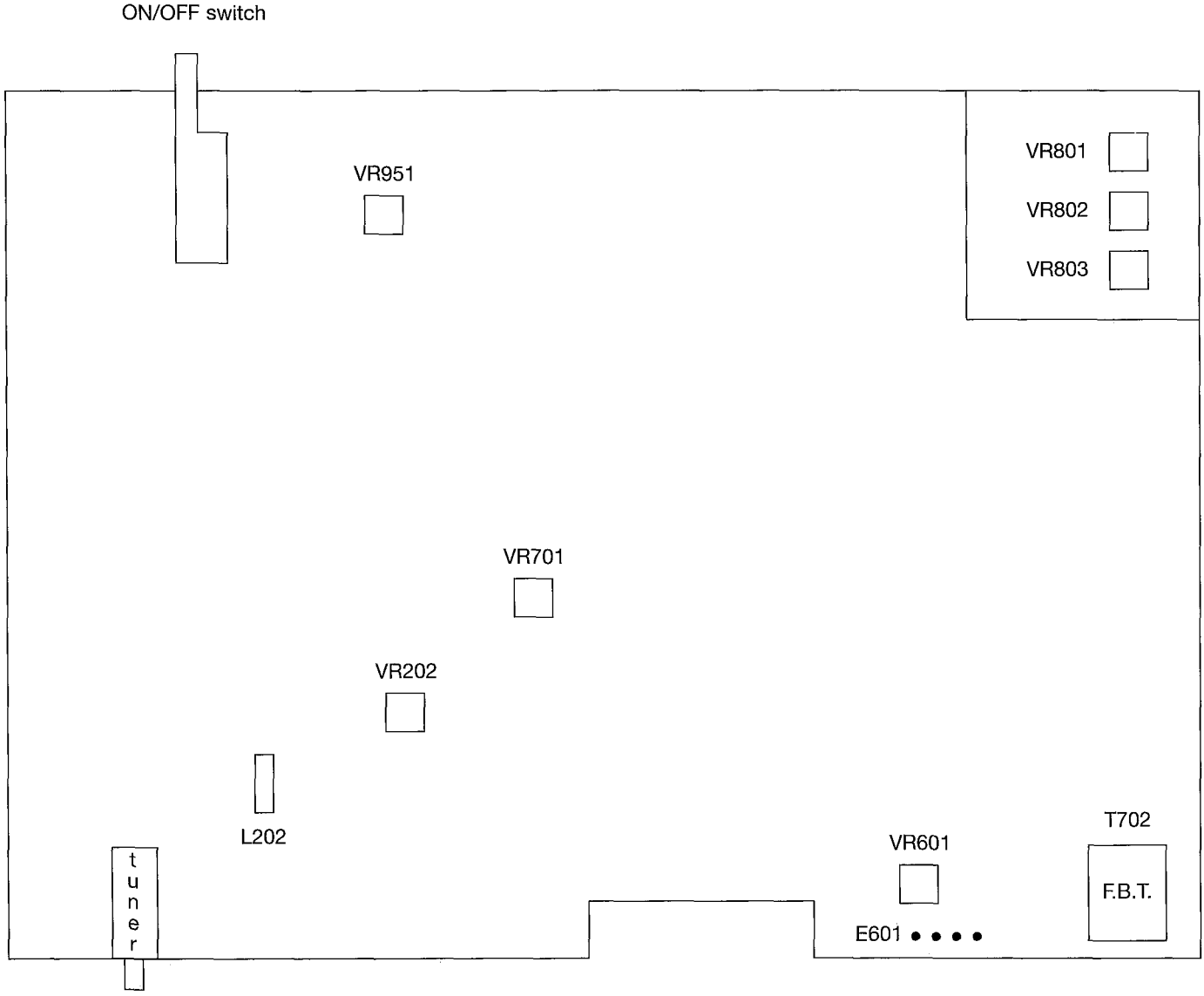
   N.B. On 51cm models, resistor value should be 1M0 and on 59cm models it should be 1M2.
3. Switch T.V. off, remove resistor, and wait 10 - 15 seconds.
4. Switch T.V. on again, check that normal operation is resumed, then return contrast and brightness levels to their original levels.

Anode/Focus s/c Check:

1. Switch T.V. on and set contrast and brightness levels to maximum.
2. Connect a 270R (20 - 30 Watt) resistor from pin 9 of the flyback transformer to ground.

   N.B. Use a 470R resistor for 51cm/59cm models.
3. Check that picture and sound disappear instantly.
4. Switch T.V. off, remove resistor, and wait 10 - 15 seconds.
5. Switch T.V. on again, and check that normal operation is resumed, then return contrast and brightness levels to their original levels.

POSITION OF ADJUSTMENT CONTROLS



VOLTAGE MEASUREMENTS

IC001 P83C055 ('R' models)			
PIN	VOLTAGE	PIN	VOLTAGE
1	varies with tuning	22	–
2	0V-5v (varies with volume)	23	–
3	0v-5v (varies with hue)	24	–
4	0v-5v (varies with colour)	25	–
5	0v-5v (varies with contrast)	26	4v8
6	0v-5v (varies with brightness)	27	4v5
7	0v-5v (varies with sharpness)	28	2v8
8	not used	29	2v8
9	1.8v	30	not used
10	0v (5v0 with direct scart input)	31	2v5
11	0v VHF-L and VHF-H (5v0 UHF)	32	3v0
12	0v VHF-L and UHF (5v0 VHF-H)	33	0v
13	0V	34	1v1 (5v0 NTSC signals)
14	0V (1v7 RGB mode)	35	5v0
15	0v (5v2 AV/RGB modes)	36	4v5
16	0v (5v0 16:9 selection)	37	4v7
17	0v (0v7 system L')	38	5v2
18	0v (5v0 system L)	39	5v2
19	3.4v (0v in standby mode)	40	5v2
20	3v8 (0v in standby mode)	41	5v5
21	0v	42	5v0

IC002 ST24C04	
PIN	VOLTAGE
1	0v
2	0v
3	0v
4	0v
5	5v0
6	5v0
7	0v
8	5v0

IC401 TDA7056	
PIN	VOLTAGE
1	N/C
2	12v
3	0v
4	0v
5	N/C
6	5v3
7	0v
8	5v2
9	N/C

IC001 SAA529X					
PIN	VOLTAGE	PIN	VOLTAGE	PIN	VOLTAGE
1	varies with tuning	19	3v4 (0v in standby mode)	36	4v8
2	0V-5v (varies with volume)	20	3v8 (0v in standby mode)	37	4v5
3	0v-5v (varies with hue)	21	N/C	38	5v4
4	0v-5v (varies with colour)	22	0v	39	5v4
5	0v-5v (varies with contrast)	23	2v7	40	0v
6	0v-5v (varies with brightness)	24	0v6	41	2v5
7	0v-5v (varies with sharpness)	25	2v3	42	3v0
8	0v (B6) 5v (DK)	26	2v6	43	0v
9	1.8v	27	0v	44	5v0
10	0v (5v0 with direct scart input)	28	0v	45	5v0
11	0v VHF-L and VHF-H (5v UHF)	29	N/C	46	4v5
12	0v VHF-L and UHF (5v VHF-H)	30	1v1 (5v NTSC Signals)	47	4v7
13	0V	31	4v7	48	5v2
14	0V (1v7 RGB mode)	32	0v	49	5v2
15	0v (5v2 AV/RGB modes)	33	0v	50	5v2
16	0v (5v0 16:9 selection)	34	0v	51	5v5
17	0v (0v7 system L')	35	0v	52	N/C
18	0v				

IC201 TDA836 1 AND 2							
PIN	VOLTAGE	PIN	VOLTAGE	PIN	VOLTAGE	PIN	VOLTAGE
1	2v9	14	3v0	27	8v0 (0-5v NTSC signals)*	40	3v8
2	5v8	15	4v2	28	3v9	41	2v5
3	5v8	16	0v (7v8 AV/RGB mode)	29	3v9	42	2v5
4	7v2	17	3v0	30	1v5	43	1v0
5	0v5	18	2v0	31	1v5	44	3v4
6	3v8	19	2v0	32	1v6	45	4v0
7	3v5	20	2v1	33	4v3	46	4v0
8	1v8	21	0v3	34	3v4	47	1v4
9	0v	22	3v4	35	2v0	48	3v9
10	8v0	23	3v4	36	8v3	49	1v9
11	0v	24	3v4	37	0v7	50	3v4
12	3v1	25	2v3	38	3v6	51	4v7
13	4v2	26	1v2	39	3v6	52	6v6

NOTE: Pins 5, 17, 25, and 26 will vary depending on the level of brightness etc. set by the customer. Pin 27 is the Hue control in NTSC signals.

* ALSO PAL FOR C & CP MODELS

IC501 TDA4661			
PIN	VOLTAGE	PIN	VOLTAGE
1	5v6	9	5v6
2	not used	10	0v
3	0v	11	2v8
4	0v	12	2v8
5	0v7	13	not used
6	not used	14	1v3
7	not used	15	not used
8	0v	16	1v3

IC502 TDA8395			
PIN	VOLTAGE	PIN	VOLTAGE
1	1v6	9	1v5
2	not used	10	1v5
3	8v8	11	not used
4	not used	12	not used
5	not used	13	not used
6	0v	14	not used
7	3v2	15	0v8
8	4v2	16	6v3

IC601 TA8427K			
PIN	VOLTAGE	PIN	VOLTAGE
1	0v	5	1v0
2	15v	6	27v
3	27v	7	1v2
4	1v0		

IC701 LM393P			
PIN	VOLTAGE	PIN	VOLTAGE
1	0v	5	
2	4v9	6	
3	4v1	7	
4	0v	8	25v5

IC901 CNY17F-2/6	
PIN	VOLTAGE
1	129v
2	128v
3	not used
4	-4v9
5	0v1
6	not used

NOTE: The pins 4 and 5 are measured from the isolated Earth of the power supply, i.e the leg of FB999.

	Q001	Q003	Q004	Q005	Q007	Q008	Q010	Q013	Q014
E	varies with tuning	0v	0v	0v	0v	0v3	0v	8v8	0v
B	varies with tuning	0v1	0v7	0v7 (0v2)	0v2 (0v7)	0v	0v	8v8 (8v1)	0v (0v7)
C	varies with tuning	4v5	0v	0v (7v8)	4v7 (0v)	9v0	6v3	8v8 (0-5v0)	8v8 (0v2)

() = AV/RGB mode

() = NTSC signals

	Q015	Q016	Q100	Q301	Q401	Q440	Q453		
E	5v5	0v	0v	1v2	3v4	12v1	1v3		
B	5v0 (5v5)	0v	0v7 (0v2)	1v8	3v5	12v1	2v1		
C	5v5 (2v5)	8v0	0v (4v5)	7v2	8v0	0v2	6v0		

() = 16:9 mode

() = VHF-L

	Q460	Q461	Q501	Q502	Q701	Q702	Q704	Q705	
E	2v0	5v0	3v5	2v5	0v	0v	98v *	0v	
B	2v5	1v5	2v5	3v2	0v5	–	97v +	0v	
C	1v5	2v7	0v	8v0	26v	106v * 1200v pp Line Pulse	0v	3v8	

	Q752	Q801	Q802	Q803	Q804	Q805			
E	2v3	2v6	2v6	2v6	8v4	3v1			
B	2v4	3v1	3v1	3v1	8v5	2v5			
C	0v	125v	125v	125v	0v1	0v			

	Q806	Q807	Q901	Q902	Q903	Q951	Q952	Q953	Q957
E	3v1	3v1	0v	–4v9	0v	6v7	0v	12v3	5v0
B	2v5	2v5	0v1	–4v2	–2v7	7v4	0v7	11v5	5v6
C	0v	0v	–2v0	–2v9	300v	128v	0v1	12v	12v

NOTE: Q901, Q902 and Q903 are measured from the isolated Earth of the power supply, i e the leg of FB999

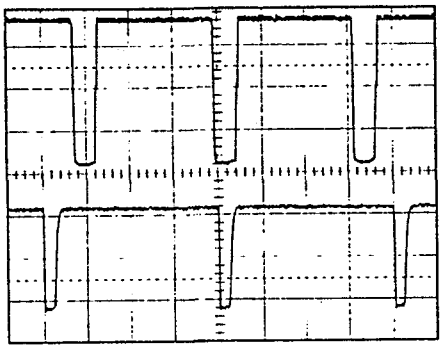
	Q4002	Q4010							
E	0v	1v9							
B	3v5	2v7							
C	0v	6v5							

WAVEFORMS

The following waveforms were taken on a colour bar signal, using a 10:1 probe. All waveforms were displayed at 20µSecs per division unless otherwise state.

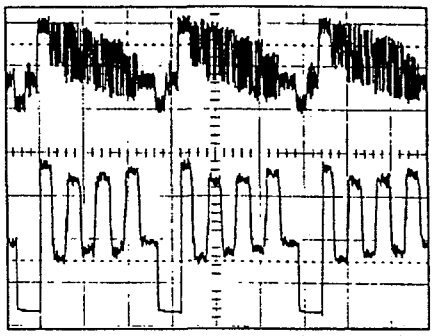
IC001 pin 26
('R' models)
pin 36
('T' models)
7v0 p.p.

IC001 pin 27
('R' model)
pin 37
('T' model)
5v0 p.p.
at 5m Secs/cm



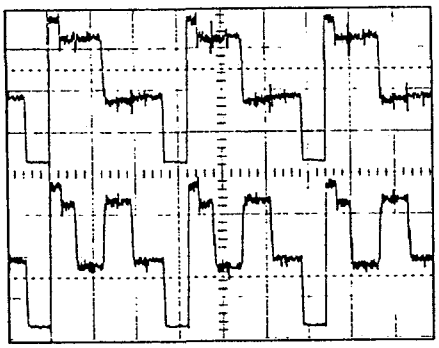
IC201
pins 7, 13, 15
2v1 p.p.

IC201 pin 18
3v6 p.p.



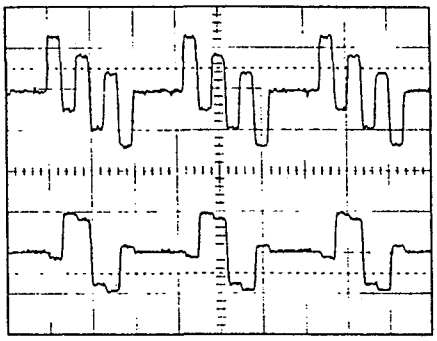
IC201 pin 19
3v6 p.p.

IC201 pin 20
3v6 p.p.



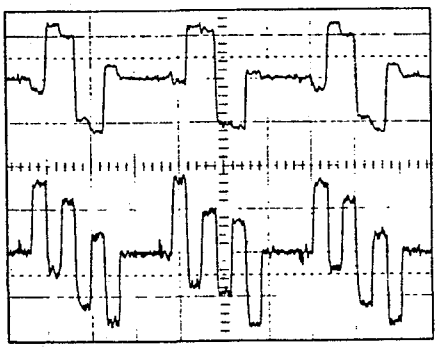
IC201 pin 28
1v5 p.p.

IC201 pin 20
1v0 p.p.

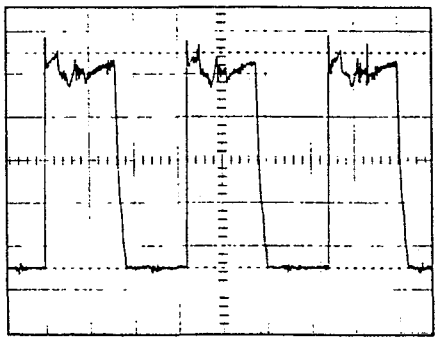


IC201 pin 30
0v5 p.p.

IC201 pin 31
0v7 p.p.

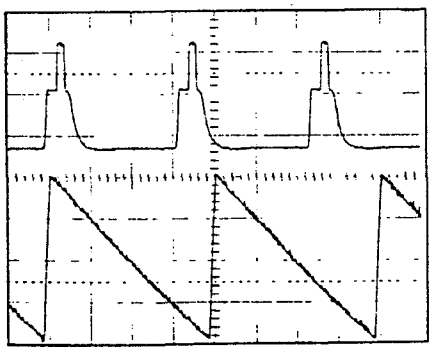


IC201 pin 37
0v5 p.p.



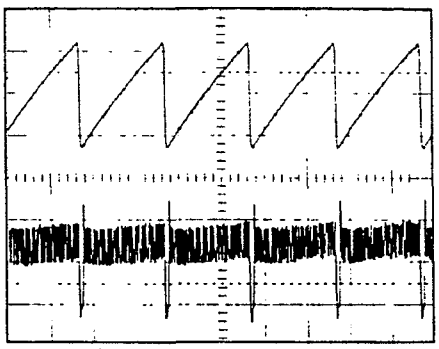
IC201 pin 3
5v p.p.

IC201 pin 41
0v8 p.p.
at 5m secs/cm



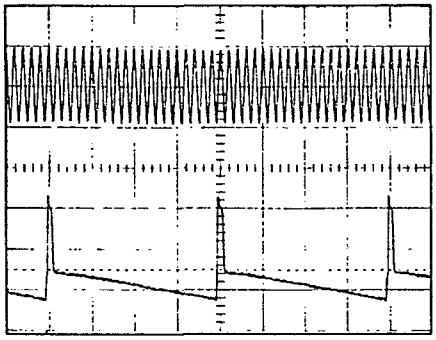
IC201 pin 42
1v3 p.p.
at 10m secs/cm

IC201 pin 43
1v5 p.p.
at 10m secs/cm



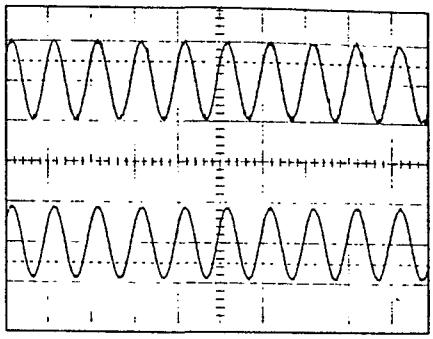
IC201 pin 50
1v9 p.p.
at 5m secs/cm

IC601 pin 2
50v p.p.
5m secs/cm



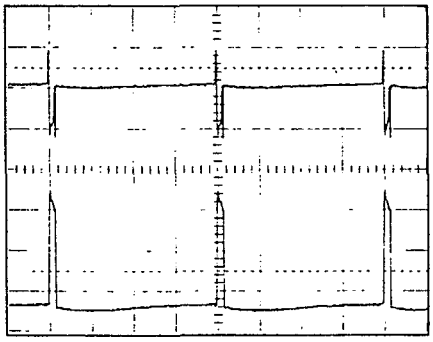
IC401 pin 3
0v2 p.p.
at 1m sec/cm

IC401 pin 6
9v0 p.p.
at 1m sec/cm



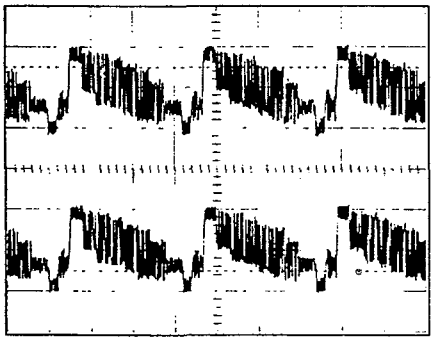
IC601 pin 4
2v1 p.p.
at 5m secs/cm

IC601 pin 3
30v p.p.
at 5m secs/cm



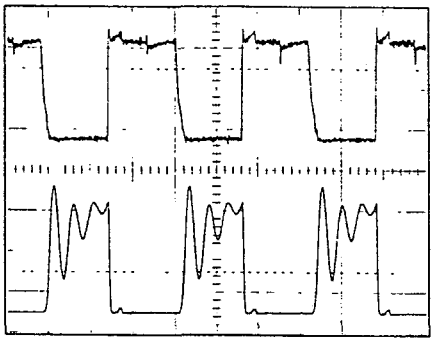
Q501 Base
2v2 p.p.

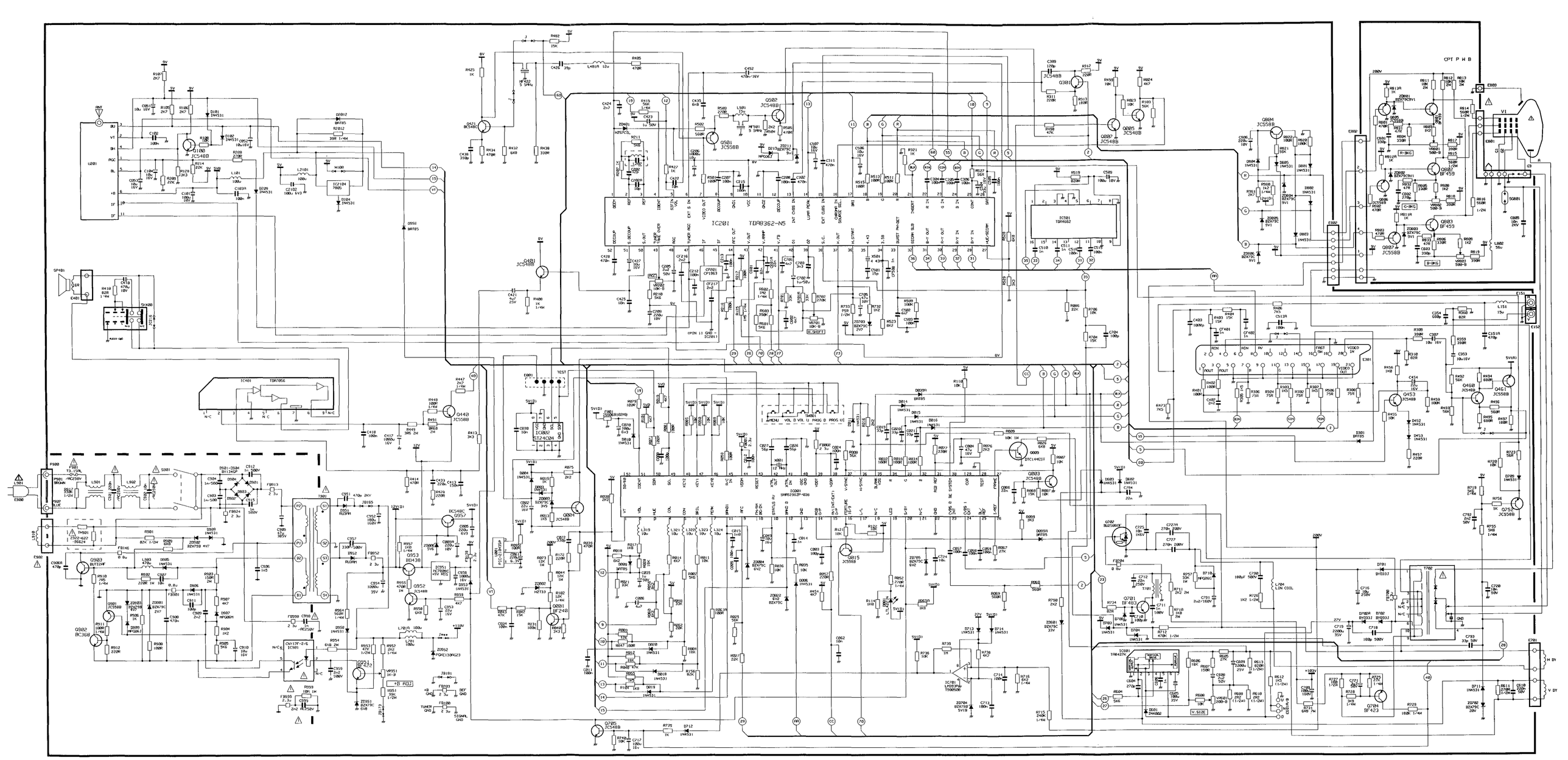
Q501 Emitter
2v0 p.p.



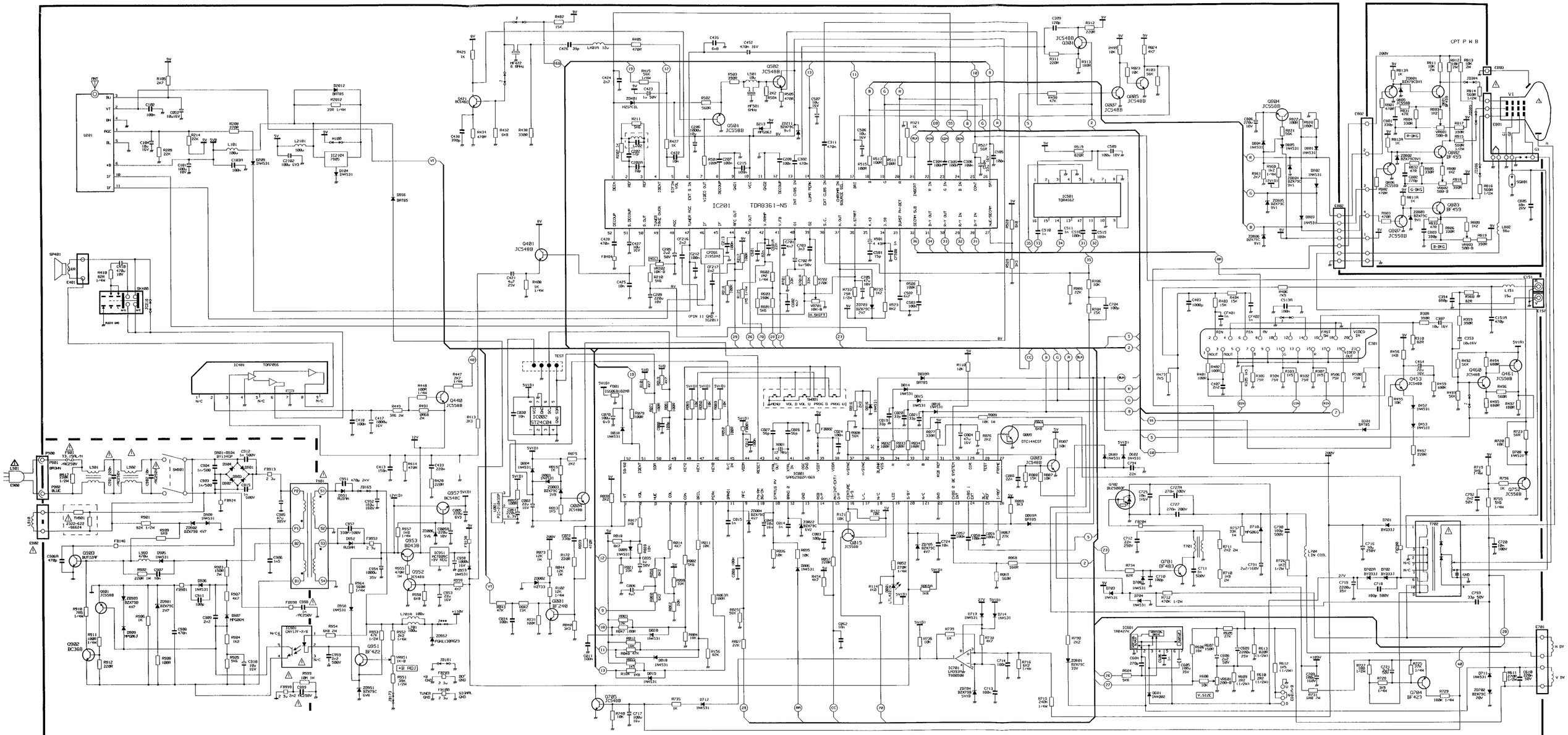
Q701 Base
0v6 p.p.

Q701 Emitter
60v p.p.

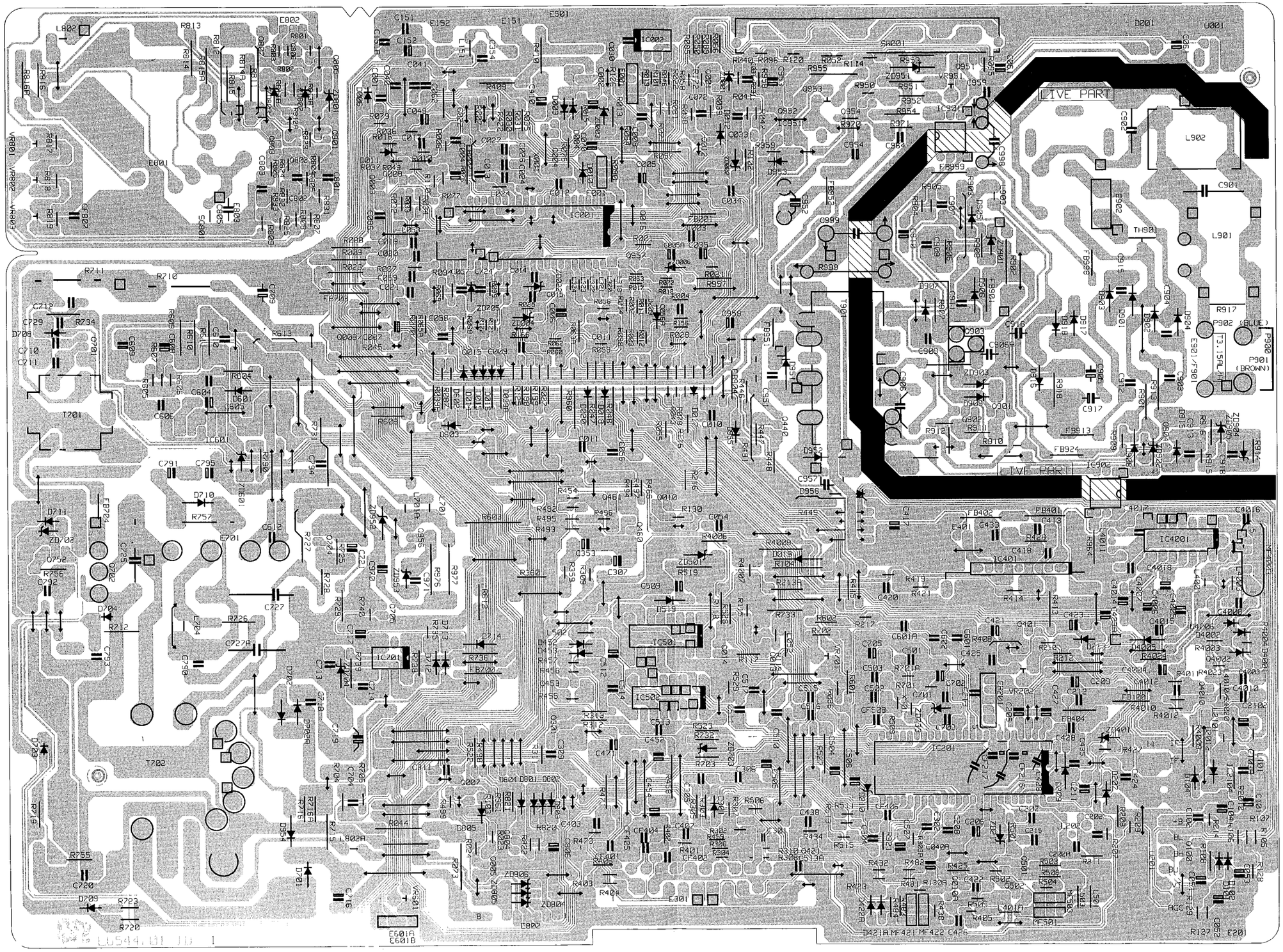




CP2117T MAIN CIRCUIT DIAGRAM



C2117T MAIN CIRCUIT DIAGRAM


LIVE PART
LIVE PART
L902
L901
TH901
P902 (BLUE)
P901 (BROWN)
T3.15AL 250V
IC001
IC002
IC201
IC401
IC4001
IC501
IC502
IC601
IC901
T201
T202
T301
T701
T901
L502
L701
L802
L901
L902
E152
E151
E901
E802
E801
E201
E301
E401
E601A
E601B
D001
U001
SW001
VR951
VR201
VR601
VR801
VR802
VR803
L6544.01 JB 1

MAIN PCB

NOTES

MODEL NO: 2117 SERIES

PRESENTATION PARTS

	TYPE	PART No
⚠ CRT TYPE	A51EAL 55X10/155X10	T154010
⚠ CABINET BACK		X263494
FRONT FRAME UK MODELS		SA00039
FRONTFRAME EXP MODELS TEXT		SA00040
FRONT FRAME EXP MODELS REMOTE		SA00041
HITACHI BADGE		X640251
I.R/L.E.D LENS		X425151
TOUCH BUTTON BLOCK		X310701
⚠ MAINS LEAD UK		E846815
⚠ MAINS LEAD EXP		E846662
MAINS KNOB		X321181
REMOTE CONTROL HANDSET UK	CLE-922A	X100073
REMOTE CONTROL HANDSET EXP	CLE-922B	X100074

MISCELLANEOUS PARTS

	TYPE	PART No
SPEAKER	16R 5" x 2"	E511137

LITERATURE

	TYPE	PART No
OPERATING GUIDE - C2117T-311	ENGLISH	X831492
OPERATING GUIDE - CP2117R-481 CP2117T-481	GREEK	X831493

PRODUCT SAFETY NOTE: Components marked with a ⚠ have special characteristics important to safety. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE of this service manual. Don't degrade the safety of this receiver through improper servicing.

CRN	Part No.	Models
C002	J0800023R	
C003	J0890074R	
C004	J0800041R	
C005	J0800056R	
C005A	J0800057R	
C006	J0800012R	
C008	J0890074R	
C009	J0880194R	
C011	J0880194R	
C012	J0880194R	
C013	J0890118R	
C014	J0890087R	
C015	J0890087R	
C019	J0890067R	
C020	J0890067R	
C021	J0890067R	
C022	J0880048R	
C024	J0880194R	TEXT
C024	J0890118R	REMOTE
C026	J0890071R	
C027	J0890071R	
C030	J0890101R	
C034	J0880194R	
C035	J0800003R	
C049	J0800015R	
C051	H163007	UK
C051	J0800015R	EXPORT
C052	J0800015R	
C053	H163007	UK
C053	J0800015R	EXPORT
C057	J0880194R	
C058	J0880194R	
C059	J0880194R	
C061	J0800056R	
C062	J0890101R	
C070	J0800047R	
C072	J0243507R	
C086	J0880048R	
C101	J0800048R	
C102	J0880194R	
C103A	J0880194R	
C104	J0800023R	
C151A	J0890083R	
C152	H163007	
C202	J0890115R	
C202A	C110182	
C205	J0800012R	
C206	J0800081N	
C207	J0880194R	
C208	J0880194R	
C209	J0800057R	
C2102	J0800047R	
C212	C150877	
C213	C150877	
C215	J0880194R	
C302	J0880066R	
C304	J0880194R	
C305	J0880194R	
C306	J0880194R	
C307	J0800015R	
C309	J0890075R	
C311	J0880066R	
C353	J0800015R	
C354	J0890085R	
C403	J0890087R	
C407	J0890092R	
C410	J0800073R	
C413	J0880059R	
C417	J0800082F	
C418	J0880194R	
C421	J0800009R	
C422	J0880044R	
C423	J0800003R	
C424	J0880036R	
C425	J0880044R	
C426	J0890122R	
C427	J0800015R	
C428	J0880066R	
C433	J0880062R	
C435	J0880042R	
C438	J0890082R	
C452	J0800001R	
C454	J0800023R	
C471	H163007	
C501	C115182	
C502	J0880039R	
C503	J0880194R	
C504	J0800032R	

CRN	Part No.	Models
C505	J0880194R	
C506	J0800015R	
C507	J0800015R	
C509	J0800048R	
C510	J0890087R	
C511	J0890087R	
C513A	C150877	
C515	J0880194R	
C516	J0880194R	
C601	C842715	
C601A	C242877	
C602	J0880039R	
C604	J0890079R	
C605	J0800328R	
C606	J0890087R	
C608	J0800005R	
C609	J0252969F	
C610	J0276345R	
C701	J0880039R	
C702	J0800003R	
C703	J0244107R	
C704	J0890074R	
C705	J0800039R	
C709	J0259152F	
C710	J0890074R	
C711	J0244501R	
C712	J0250511R	
C713	J0880194R	
C714	J0880194R	
C716	J0253972	
C717	J0800049R	
C718	J0243504R	
C719	J0253934F	
C720	J0880009R	
C721	J0800007R	
C724	J0890101R	
C725	C140755	
C727	J0299931F	
C727A	J0299931F	
C790	J0243504R	
C791	J0253953R	
C792	J0890092R	
C793	J0890067R	
C794	J0880048R	
C795	H163007	
C801	J0890081R	
C802	J0890079R	
C803	J0890082R	
C805	E884110	
C806	J0800057R	
⚠C901	C252752	
⚠C902	C140758	
C903	J0244501R	
C904	J0244501R	
C905	J0253873F	
C906	J0244213R	
C906A	J0244202	
C907	J0880044R	
C908	J0880066R	
C909	J0880035R	
C910	J0800015R	
C911	J0890074R	
C912	J0244501R	
C915	J0244501R	
C951	JAJ00129R	
C952	J0259402F	
C953	J0800023R	
C954	J0800084N	
C957	J0243507R	
C958	J0800082F	
C959	J0244505R	
⚠C998	JAJ00182N	
⚠C999	C232753	
CF216	J0890092R	
CF217	J0890092R	
CF401	J0890087R	
CF402	J0890087R	
CF508	J0890087R	
CP201	E518060	UK
CP201	J2305571	EXPORT REMOTE
CP201	J2305572	EXPORT TEXT
D001	T547047	
D003	J2348921M	
D004	J2348921M	
D006	J2348921M	
D009	T531055	
D010	J2348921M	

CRN	Part No.	Models
D011	J2348921M	
D012	H163007	
D014	J2348921M	
D015	J2348921M	
D016	J2348921M	
D018	J2348921M	
D019	J2348921M	
D020	J2348921M	
D039A	T531055	
D099A	T531055	
D101	J2348921M	
D102	J2348921M	
D104	J2348921M	
D2012	T531055	
D207	H163007	
D209	J2348921M	
D213	J2343963M	
D301	T531055	
D422A	H163007	
D452	J2348921M	
D453	J2348921M	
D519	H163007	
D601	T531063	
D602	J2348921M	
D603	J2348921M	
D701	T431113	
D702	T431113	
D702A	T431113	
D703	J2348921M	
D704	J2348921M	
D708	J2348921M	
D709	J2348921M	
D710	J2343962M	
D711	J2348921M	
D712	J2348921M	
D713	J2348921M	
D714	J2348921M	
D801	J2348921M	
D802	J2348921M	
D803	J2348921M	
D804	J2348921M	
D805	J2348921M	
D901	J2344111M	
D902	J2344111M	
D903	J2344111M	
D904	J2344111M	
D905	J2348921M	
D906	J2348921M	
D907	T431123	
D908	J2348921M	
D909	J2343963M	
D951	J2336613	
D952	T431125	
D953	J2348921M	
D956	T531055	
D958	J2348921M	
E001	E825481	
E1	E841052	
E151	E826139	
E152	E826140	
E201	E843240	
E301	E826923	
E401	E846644	
E601A	E826213	
E601B	E825481	
E701	H114002	SPRING
E701	J2665272	PIN BASE
⚠E801	E822924	
E802	J2995602	
E803	E843241	
E901	J2721792	
E902	J2661751	
F001	J2791759R	
⚠F901	E882368	
FB001	J2123462M	
FB002	J2123462M	
FB100	J2123462M	
FB138	J2123462M	
FB146	J2123461M	
FB700	J2123462M	
FB703	J2123462M	
FB704	J2123461M	
FB705	H163007	
FB901	J2123461M	
FB904	H163007	
FB913	J2123462M	
FB924	J2123462M	

PRODUCT SAFETY NOTE: Components marked with a ⚠ have special characteristics important to safety. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE of this service manual. Don't degrade the safety of this receiver through improper servicing.

CRN	Part No.	Models
FB951	H163007	
FB952	J2123462M	
FB998	J2123462M	
FB999	J2123462M	
IC001	T900665	EXPORT REMOTE
IC001	T900722	EXPORT TEXT
IC001	T900739	UK
IC002	E730150	UK
IC002	E730151	EXPORT
IC201	T900623	
IC2104	T900345	
IC401	T900747	
IC401A	H235389	
IC401B	J4522881	
IC501	T900598	
IC601	J2003951	
IC601A	H235390	
IC601B	G884020	
IC701	T900508	
⚠IC901	T548014	
IC951	J2000252	
IC951A	H235369	
IC951B	G560333	
IC951C	G291023	
L024	J2123107M	
L053	H163007	
L101	J2122956M	
L151	J2123105M	
L202	J2145877U	
L2101	J2123781R	
L319	H163007	UK EXP REMOTE
L319	J2123103M	EXP TEXT
L321	H163007	UK EXP REMOTE
L321	J2123103M	EXP TEXT
L322	H163007	UK EXP REMOTE
L322	J2123103M	EXP TEXT
L323	H163007	UK EXP REMOTE
L323	J2123103M	EXP TEXT
L324	H163007	UK EXP REMOTE
L324	J2123103M	EXP TEXT
L401A	J2122944M	
L501	J2123103M	UK
L501	J2123105M	EXP
L701	J2123781R	
L701A	J2123781R	
L704	J2229522	
L802	L300011	
L802A	H163007	
⚠L901	J2122694	
⚠L902	J2124531	
L903	J2125593	
⚠L910	L130038	
M1	J2656609	
MF422	J2142602	EXP
MF422	J2142603R	UK
MF501	J2142243	EXP
MF501	J2142244R	UK
P900	E825259	
Q001	T633134	
Q003	J2315891R	
Q004	J2315891R	
Q005	J2315891R	
Q007	J2315891R	
Q009	J2326873R	
Q015	J2315921R	
Q100	J2315891R	
Q301	J2315891R	
Q401	J2315891R	
Q421	T631286	
Q440	J2315921R	
Q453	J2315891R	
Q460	J2315891R	
Q461	J2315921R	
Q501	J2315921R	
Q502	J2315891R	
Q701	T633140	
Q702	J2315161	
Q702A	H235305	
Q702B	G884020	
Q704	T633138	
Q705	J2315891R	
Q752	J2315921R	
Q801	T633137	
Q802	T633137	
Q803	T633137	
Q804	J2315921R	
Q805	J2315921R	
Q806	J2315921R	

CRN	Part No.	Models
Q807	J2315921R	
Q901	J2315921R	
Q902	T631291	
Q903	J2314791R	
Q903A	H234344	
Q903B	G884020	
Q951	T633133	
Q952	J2315891R	
Q953	T632084	
Q957	T631286	
R002	J0700051M	
R003	J0700055M	
R004	J0700057M	
R007	J0700054M	
R008	J0700064M	
R009	J0110169S	
R011	J0700054M	
R012	J0700057M	
R013	J0700043M	
R014	J0700049M	
R015	J0700041M	
R016	J0700045M	
R017	J0700044M	
R018	J0700053M	
R019	J0700049M	
R021	J0700061M	
R022	H163007	
R023	J0700054M	
R024	J0700049M	
R025	J0700064M	
R026	J0700052M	
R027	J0700058M	
R028	J0700057M	
R030	H163007	
R032	J0700027M	
R033	J0700027M	
R034	J0700027M	
R035	J0700054M	
R036	J0700054M	
R037	H163007	
R038	J0700045M	
R039	J0700036M	
R040	J0700047M	
R041	H163007	
R042	J0700056M	
R043	J0700063M	
R044	J0110271S	
R045	H163007	
R046	H163007	
R047	J0700027M	
R048	J0700063M	
R050	J0700054M	
R052	R227330	
R055	J0700043M	
R056	J0700053M	
R057	J0700032M	
R058	J0700027M	
R060	J0187084M	
R062	J0187096M	
R063A	J0700027M	
R065A	J0700044M	
R067	J0700059M	
R068	J0700037M	
R069	J0700037M	
R070	H163007	
R071	J0700027M	
R073	J0110271S	
R075	J0700045M	
R076	J0700045M	
R077	J0700034M	
R079	J0700027M	
R081	J0700027M	
R085	J0700054M	
R086	J0700058M	
R087	J0700054M	
R088	J0700056M	
R089	J0700054M	
R094	H163007	
R095	J0700027M	
R096	H163007	
R098	J0700061M	
R099	J0700047M	
R101	J0700049M	
R102	R142330	
R103	J0700064M	
R104	J0700044M	
R105	J0700046M	

CRN	Part No.	Models
R106	J0700046M	
R107	J0700046M	
R108	J0700054M	
R110	J0700054M	
R114	J0700041M	
R121	J0700054M	
R122	J0700054M	
R125	R165716	
R126	H163007	
R128	J0700047M	
R156	J0700066M	
R172	J0700032M	
R198	H163007	
R199	H163007	
R2012	R319330	
R207	J0700041M	
R208	J0700033M	
R209	J0700058M	
R210	J0700051M	
R211	J0700051M	
R213A	H163007	
R214	J0700058M	
R216	J0700067M	
R217	J0700067M	
R231	J0700067M	
R302	J0187038M	
R303	J0700043M	
R304	J0187038M	
R305	J0700043M	
R306	J0187038M	
R307	J0700043M	
R308	J0187038M	
R309	J0700035M	
R310	J0700026M	
R311	J0700032M	
R312	J0700032M	
R313	J0700031M	
R321	J0700041M	
R359	J0700035M	
R360	J0700026M	
R401	J0700027M	
R402	J0700027M	
R403	J0700056M	
R404	J0700056M	
R405	J0700036M	
R406	J0187086M	
R408	R130330	
R409	H163007	
R410	R812330	
R413	J0700047M	
R414	J0700036M	
R415	R546330	
R425	J0700041M	
R427	J0700041M	
R428	J0700032M	
R432	J0700052M	
R434	J0700036M	
R438	J0700034M	
R447	R237330	
R448	R120330	
R449	J0147037AF	
R454	J0700049M	
R455	J0700054M	
R456	J0700041M	
R457	J0700032M	
R458	H163007	
R459	J0700067M	
R471	H163007	
R473	J0187086M	
R482	J0700056M	
R484	H163007	
R491	J0147020AF	
R492	J0700064M	
R493	J0700064M	
R494	J0700038M	
R495	J0700038M	
R496	J0700037M	
R497	J0700031M	
R498	J0700063M	
R499	J0700054M	
R501	J0700027M	
R502	J0700037M	
R503	J0700033M	EXP TEXT
R503	J0700034M	EXP REMOTE
R503	J0700035M	UK
R504	J0700045M	
R505	J0700036M	

PRODUCT SAFETY NOTE: Components marked with a ⚠ have special characteristics important to safety. Before replacing any of these components, read carefully the PRODUCT SAFETY NOTICE of this service manual. Don't degrade the safety of this receiver through improper servicing.

CRN	Part No.	Models
R506	J0187038M	
R509	J0700067M	
R511	J0700027M	
R513	J0700027M	
R515	J0700027M	
R519	J0700039M	
R523	J0700053M	
R527	J0700024M	
R528	J0700052M	
R529	J0700047M	
R601	J0700051M	
R602	R162716	
R603	J0700075M	
R604	J0700051M	
R605	J0700059M	
R606	J0700057M	
R607	J0700029M	
R608	J0700054M	
R609	J0113684M	
R610	J0113684M	
R611	J0113735M	
R612	J0113754M	
R613	J0113748M	
R701	J0700061M	
R701A	J0700061M	
R702	J0700073M	
R704	J0700056M	
R706	J0700054M	
R710	J0110251S	
R711	J0110253S	
R712	R457714	
R715	R254736	
R716	J0119626M	
R719	R536330	
R720	J0700054M	
R723	J0700024M	
R725	R247330	
R726	J0113752M	
R727	R100549	
R728	R339330	
R729	R158330	
R731	J0147630	
R732	J0700042M	
R733	J0113722M	
R734	J0700026M	
R735	J0700041M	
R736	J0700054M	
R738	J0700049M	
R739	R160716	
R740	J0700054M	
R755	R536330	
R756	J0700041M	
R757	R343570	
R790	J0700045M	
R801	J0700036M	
R802	J0700036M	
R803	J0700036M	
R804	J0700034M	
R805	J0700034M	
R806	J0700034M	
R807	J0700042M	
R808	J0700042M	
R809	J0700042M	
R811	J0110269M	
R811A	J0700041M	
R812	J0110269M	
R812A	J0700041M	
R813	J0110269S	
R813A	J0700041M	
R814	J0113744M	
R814A	H163007	
R815	J0113744M	
R815A	H163007	
R816	J0113744M	
R816A	H163007	
R817	J0700035M	
R818	J0700035M	
R819	J0700035M	
R820	J0700067M	
R821	J0700064M	
R822	J0700027M	
R831	J0700023M	
R832	J0700023M	
R833	J0700023M	
R901	R842731	
R902	J0110129M	
R903	J0110225M	
R904	J0700042M	

CRN	Part No.	Models
R905	J0700051M	
R906	J0700041M	
R907	J0700049M	
R908	J0700027M	
R909	J0700052M	
R910	J0114014M	
R911	R120330	
R912	J0700032M	
⚠R917	R353714	
R950	H163007	
R951	J0113789M	
R952	R232330	
R953	J0113791M	
R954	R638571	
R955	J0110137S	
R957	R130330	
R958	J0700052M	
R959	J0700049M	
R960	R132330	
R961	J0700046M	
R964	R526330	
⚠R999	R170727	
RIV--	JEU00212	RIVET
SG801	J2340039	
SK400	J2671351	
SW001	J2632853	
⚠SW901	J2633391	
T701	J2260291U	
⚠T702	J2435066	
⚠T901	L380109	
TH901	E441045	
U001	JCZ00502U	
U201	E710042	EXPORT
U201	E710045	UK
VR202	J0160215R	
VR601	J0160421R	
VR701	J0160215R	
VR801	J0160413R	
VR802	J0160413R	
VR803	J0160413R	
VR951	J0160211R	
W402	EC5A190A	
W701	EC5A110A	
X001	E516030F	
X501	J2792151	
Z964	J9451136	
ZD002	J2335991M	
ZD003	T536180	
ZD004	T536179	
ZD006	T536224	
ZD022	T536179	
ZD211	T536184	
ZD401	J2339061M	
ZD601	T536215	
ZD702	T536241	
ZD703	T536190	
ZD704	T536201	
ZD705	T536179	
ZD801	T536184	
ZD802	T536184	
ZD803	T536184	
ZD804	T536184	
ZD805	T536184	
ZD806	T536184	
ZD901	T536190	
ZD902	T536223	
ZD903	T536223	
ZD951	T536175	
ZD952	J2344121M	

CRN	Part No.	Models